GORDON (J. C.)

Progress in the amelioration of certain forms of deafness and impaired hearing.

Note.

THANKS to anasthesia, asepsis, electric illumination, improved surgical instruments, increased knowledge and increased operative skill, aural surgery has made great advances in recent years.

The lecturer's object has not been to exploit the skill of a few aural surgeons to the disadvantage of others, but simply to introduce sufficient evidence of progress in this branch of surgery to arouse greater interest in the subject, both among laymen and the profession.

While stapedectomy may be rarely resorted to, the advances made in aural surgery, the rapidity and painless nature of middle-ear operations, and the great benefit to health, to comfort, and, *in many cases, to the hearing,* resulting from judicious surgery, *call for thorough and stated re-examinations of the ears of the deaf, including the so-called deaf and dumb, by otologists of recognized standing.* It is estimated that not less than 250,000 young persons in the United States need such examination with reference to the amelioration of deafness by judicious remedial measures.

For economy's sake, the lecturer's explanation of DR. FRANK BAKER'S series of large charts representing the entire scheme of the ear has been omitted, and certain plates from DR. HARRISON ALLEN'S Lake-George lectures have been inserted in this brochure. The lectures, as printed, have been made up from the stenographer's notes by a friendly hand without submission of proof sheets to the speaker for revision.

Particular attention is invited to marked passages ~~in the 2d lecture.~~

J. C. G.

AMERICAN ASSOCIATION TO PROMOTE THE TEACHING OF SPEECH TO THE DEAF.

Fourth Summer Meeting,

CHAUTAUQUA, N. Y., JULY, 1894.

[PROCEEDINGS ISSUED IN SECTIONS.]

PROGRESS IN THE AMELIORATION OF CERTAIN FORMS OF DEAFNESS AND IMPAIRED HEARING

BY

DR. J. C. GORDON.

ROCHESTER:
WESTERN NEW YORK INSTITUTION FOR DEAF-MUTES
1894.

PROGRESS IN THE AMELIORATION OF CERTAIN FORMS OF DEAFNESS AND IMPAIRED HEARING

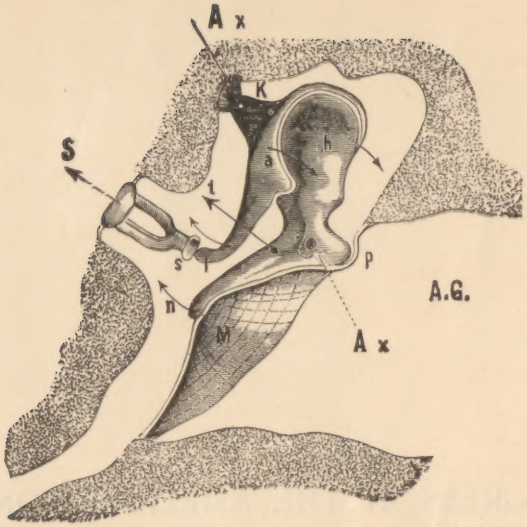
BY

DR. J. C. GORDON

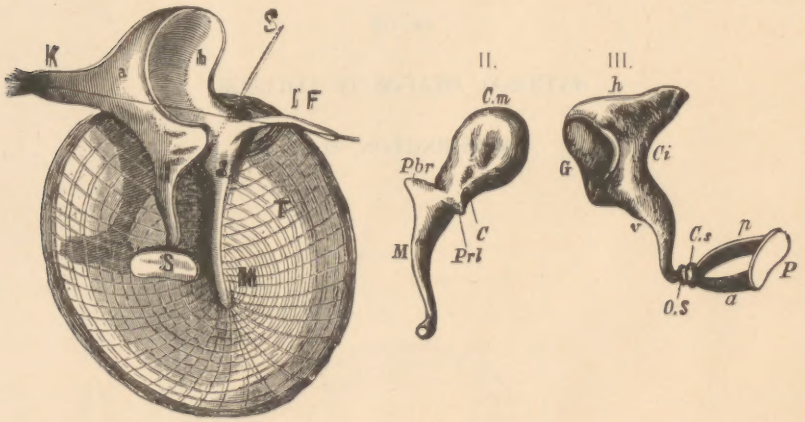
OF THE

NATIONAL DEAF-MUTE COLLEGE,

WASHINGTON, D C.



Tympanum or Middle Ear, Auditory Ossicles (left) Magnified—*A G* external auditory meatus: *M*, membrana tympani which is attached to the handle of the malleus *n*; and near it the short process, *p*; *h*, head of the malleus; *a*, incus; *k*, its short process with its ligament; *l*, long process; *s*, orbicular ossicle so-called; *S*, stapes; *Ax*, *Ax*, is the axis of rotation of the ossicles it is shown in perspective, and must be imagined to penetrate the plane of the paper; *t*, line of traction of the tensor tampani. The other curved arrows indicate the movement of the ossicles when the tensor contracts; *t*, grooved prominence.



I. Tympanic membrane and Auditory Ossicles (left) Seen from Within, *i. e.*, from the tympanic cavity. *M*, manumbrium or handle of the malleus; *T*, insertion of the tensor tympani; *h*, head; *lF*, long process of the malleus; *a*, incus, with the short (*K*) and the long (*l*) process; *S*, plate of the stapes; *Ax*, *Ax*, is the common axis of rotation of the auditory ossicles; *S*, the pinion-wheel arrangement between the malleus and incus.

II. and III. The Auditory Ossicles (right).—*C. m.* head; *C*, neck; *Pbr*, short process; *Prl*, long process; *M*, handle of the malleus; *Ci*, body of Incus; *G*, articular surface; *h*, short, and *v*, long process of the incus; *O S* so-called lenticular or orbicular ossicle: *C*, *s*, head; *a*, anterior, and *p*, posterior limb of the stapes: *P*, plate or foot-piece of the stapes.

PROGRESS IN THE AMELIORATION OF CERTAIN FORMS OF DEAFNESS AND IMPAIRED HEARING.

It seems a little remarkable that those whose life-work is devoted to the amelioration of deficiencies due to deafness, should know so little about the organ of hearing as most of us do. And it will certainly be entirely inappropriate for me to attempt to give an explanation of the ear after the elaborate course of lectures on this subject by Dr. Harrison Allen at Lake George.

In the great majority of the cases we have to deal with, the trouble in hearing is chiefly with the curious conducting mechanism of the middle ear. The statistics furnished in regard to deafness are of very little value indeed, in helping us to render any benefit to those who are deaf, however interesting they may be in other respects. They furnish no clue to treatment by surgeons or others. In the great majority of cases of deafness as a result of disease, the disease is in the middle ear, and whatever be its character, the ultimate result in general, is a thickening or partial loss of the tympanum, an ankylosis or closing together of the joints of the bones of the ear; and, worst of all, the plate of the stapes becomes utterly unable to work, or move. In a number of cases examined it has been found that the play of the stapes was absolutely prevented, so that even a mallet and chisel could with difficulty detach the adhesions.

Now, in the medical practice of the present day, great efforts are made to effect the mobilization of the transmitting mechanism. Aurists meet with insuperable difficulty in many cases owing to intra-tympanic adhesions, and science has so far not discovered any absolutely certain way of overcoming these adhesions by any merely medicinal treatment, or system of massage without recourse to aural surgery.

Seventy-two per cent. of deafness from disease is connected with the thickening of the tympanum, which renders the transmitting mechanism in the middle ear utterly useless. This percentage has been obtained from 2,794 cases out of 4,142 examined by

Blake, Burnett and Spenser. About 25 per cent. are connected with the outer portion of the ear; and not more than 3 per cent. at most are connected with the inner ear, the essential organ of hearing. The portion of the labyrinth, known as the semi-circular canals is now generally admitted not to be an organ of hearing, but of balancing, and of direction or co-ordination of movement.

This transmitting mechanism becoming stiffened and comparatively useless, the problem has been what to do with it. Early in the century it was recommended to perforate the tympanum and let air into this cavity, hoping that would be of some benefit. The eustachian tube, frequently becomes practically closed, so that there is a difference of atmospheric pressure between the outside and inside of the tympanum, causing an excessive thrust upon the tympanum and chain of bones, and reducing the elasticity of these parts. These perforations have been made, producing an equilibrium, and in certain cases benefit has been derived from this slight surgical operation,—the perforation of the tympanum. The difficulty about it is that these perforations heal up rapidly, and need to be opened over and over again, and of course the patient objects to that. In the operation as now performed the tympanum is removed permanently in many cases.

Late in this century, surgery has made such progress that aural surgeons have undertaken to operate upon these three bones, or portions of them, in connection with the tympanum, effecting the removal of the tympanum, sometimes effecting the removal of the malleus, and in some cases disarticulating at the first joint, and in others removing the incus; but the latest and the most startling operation consists in the removal of the stapes, something which until recently it was deemed quite impossible to accomplish by any legitimate surgical operation.

Partial excision of the drumhead was recommended by Sir Astley Cooper, and others; but the drumhead and malleus were not excised until 1872, when Schwartze performed the operation. He removed the major part of the tympanum, and removed the malleus in 1873. Five years later, in 1878, Kessell of Jena, reported the removal of the drumhead, the malleus, and the incus, and in a short time after that, he performed the operation in five other cases. The results were highly favorable to the hearing,

but a growth rapidly formed, the tympanum closed up, and there was little benefit from the operation ultimately.

Kessell's experiments on the lower animals, on dogs, birds, and especially pigeons, in 1871, were very instructive. He removed from these the stapes and other portions of the apparatus corresponding to the same in the human ear. In a very short time after the operation was performed, and healing occurred, these animals apparently heard as well as before—quite as well perhaps as any animals, and much better than in the case of persons whose transmitting mechanism is impaired in any way. The experiments upon these animals led Kessell to attempt several other experiments of a like character. In 1881, Lucae reported the excision of the drumhead and malleus in 25 cases. There was no deterioration of hearing in any, and a remarkable improvement in hearing in a number of them. In 1883 his operations exceeded 40, and still with good results in a majority of them; while there was no benefit in a few cases, on the whole the results were favorable. In 1885, he published the results of 53 operations. In all of them he removed the malleus, and he performed the removal of the incus in some cases. In a resumè of Lucae's cases, we find that in thirty of them, there was an adhesion and thickening, and the ankylosis of these small bones was considerable. In 9 cases the hearing improved considerably; in 19 cases the hearing improved slightly; in 18 cases the hearing was no worse; in 7 in which it was bad when he began, the deafness was increased.

Taking this in another way: among Lucae's cases there were 28 cases of improvement in which the high tones of the human voice were heard better than before; in 21 of these cases the opening in the drumhead remained open; in 6 there was an entire closure of the drumhead. Stacke of Erfurt reports recently ten cases of the removal of the malleus, and all of them showed marked improvement of the hearing. A prominent aural surgeon in the city of New York, whom many of you know by his works, Dr. Sexton, has been one of the most daring, consistent with caution, yet most successful in the line of middle-ear surgery. His first operation for chronic purulent inflammation of the middle ear was in 1886. He could not practically operate as he desired, until the great advance of electric science enabled him to use the electric light in the illumination of the middle ear. In 1888 he reported 29 cases, 15 of which were cured

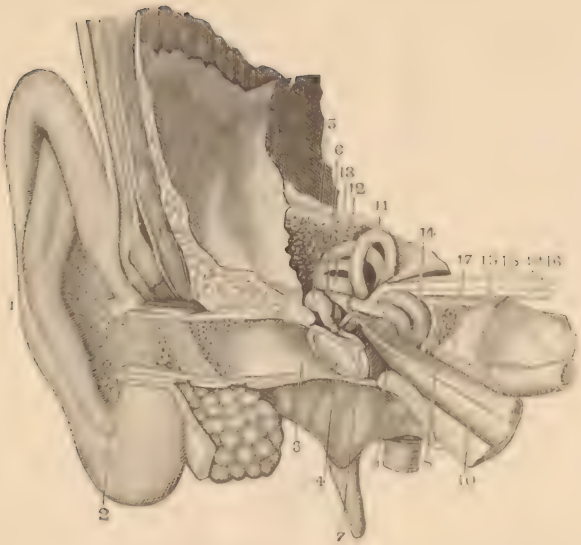
completely, and 13 improved. Of these cases, in 19 he removed the malleus and incus, in 7 he removed the malleus alone, in 3 he made an incision of the drum. He took out the incus, leaving the stapes in place. The hearing indicated a marked improvement in 11 cases. The gain for the human voice was very considerable indeed, from 75 to 100 per cent., which made it worth while to undergo the operation.

Now I want to say a word in regard to Dr. Sexton's operations. He says that when this operation is indicated, the patient need have no fear; the excision of the drumhead, and the removal of the malleus and incus, or either one, or both of them, is performed with very great rapidity, it takes only a few seconds, involves not more than a dozen tiny drops of blood, the patient does not feel it at all, and is usually able to take all his meals, while the healing is so perfect, thanks to aseptic surgery, that there is no need of any further treatment. Of course the case needs to be under the care of the surgeon. But it is all performed very rapidly; the healing in cases of good health is rapid and perfect, and the operation performed, in these cases at least, led to no ill results.

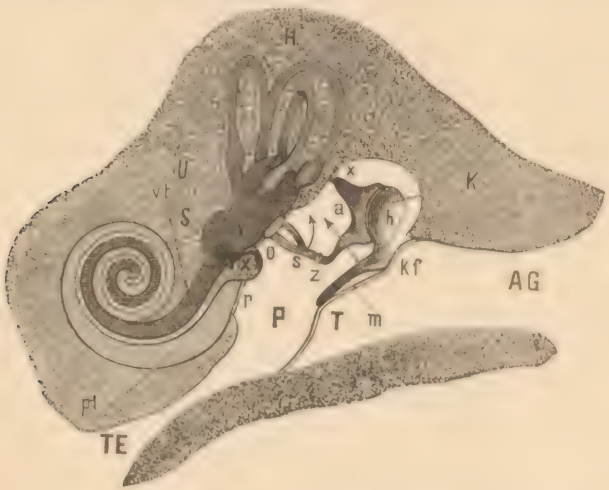
Dr. Sexton has performed this operation since 1886 with universally good results, and in the earliest cases operated upon, the hearing that was improved continues to be as good as it was at the time of the operation, and much better than it was before.

It may be of interest to know when the operation is indicated. In a general way, in cases of deafness, I should say that the friends of persons becoming deaf should consult the highest attainable recognized authority in aural surgery, at the earliest possible moment, and feel perfectly safe in following his advice. But it may be of interest to know that Dr. Sexton and other aural surgeons say that these operations are especially indicated where the deafness, from non-suppurative disease of the middle ear, is noticed to be progressive, following degeneration of the ear, getting worse and worse, — then you may know that this operation is advisable.

Suppose the hearing is very bad indeed, and at a stand-still, then it will rest with an experienced aural surgeon to decide whether an operation should be performed or not; but if the hearing is deteriorating, you may know that the operation is advisable.



Section Showing Organs of Hearing.—1. Pima or auricle; 2. Conch with orifices of sebaceous and serumenous glands; 3. Osseous portion of external auditory canal; 4. External surfaces of the membrana tympani; 5. Anterior part of the incus; 6. Head of the malleus; 7. Handle of the malleus lodged between the internal and middle layers of the membrana tympani; 8. Tensor tympani with its tendon at a right angle to be attached at the inner margin of the base of the handle of the malleus; 9. Cavity of the tympanum; 10. Expanded portion of the Eustachian tubes; 11. Superior semi-circular canal; 12. Posterior semi-circular canal; 13. External semi-circular canal; 14. Cochlea; 15. The internal auditory canal where the wall has been taken away to show the nerves which its transmits; 16. Facial nerve; 17. The great superficial petrosal nerve passing from the geniculate ganglion of the facial toreach its destination; 18. Vestibular branch of the auditory nerve. 19. Cochelar branch of the auditory nerve.



Scheme of the Organ of Hearing.—*AG*, eternal auditory meatus; *T*, tympanic membrane; *K*, malleus with its head (*h*), short process (*kf*), and handle (*m*); *a*, incus, its short process (*x*), and its long process united to the stapes (*s*) by means of the os orbiculari so-called (*z*); *P*, middle ear; *o*, fenestra ovalis; *r*, fenestra, rotunda; *x*, beginning of the lamina spiralis of the cochlea; *pt*, scala tympani, and *vt*, scala vestibuli; *V*, vestibuli; *S*, saccule; *U*, utricle; *H*, semi-circular canals; *TE*, eustachian tube. The long arrow indicates the line of traction of the tensor tympani; the short curved one, that of the stapedius.

In suppurative disease of the middle ear the operation is generally indicated as the only hope of relief.

I have a letter from Dr. Sexton in which he says that he has no doubt whatever from his knowledge of a number of cases of pupils in institutions for the deaf and dumb that a great many of our children should be operated upon. He thinks that there are a great many children whose hearing would be benefitted, and whose general health and comfort would be very much improved by undergoing this operation.

Other aural surgeons have gone still further, and have performed operations involving the removal, or partial removal, of the stapes. It is an exceedingly tiny bone, and the whole operating field is smaller than the end of a lead-pencil; so that it is exceedingly delicate to operate upon it. There is not very much room; the instrument must be strong as well as sharp, and there must be room for light and for the use of the instrument; and the bones in some cases have to be extracted from a very small passage. Dr. Blake, however, in 1892, attempted with success, the removal of the stapes. He holds that the trouble in a great majority of cases arises from the condition of the stapes; much more so than the condition of either of the other bones. It is the key to the situation, according to Dr. Blake.

Dr. Kessel found in a great many cases that the plate of the stapes was firmly attached and he attempted to improve the condition, not by removing the bone, but by cutting around it. Immediately after cutting around it, a system of massage was practiced, a modification of Hommell's method, of which I shall speak presently.

I may say that the operation upon the stapes by Dr. Blake, of Boston, was performed by him and his assistant in a small number of cases with very remarkable effects. Shortly after Dr. Blake began performing this operation in 1892 he met with an accident which temporarily disabled his hand, and his assistant, Dr. F. L. Jack, then took up the work and performed a number of operations after him.

Of the cases operated upon, I have a summary of sixteen, in which all, or a part of the stapes, was removed. In some cases this bone is in a decayed condition, and crushes under the most delicate handling.

In the 1st case on this record, before operation, a moderately loud voice could be heard at the distance of one foot; after

the operation a moderately loud voice could be heard at the distance of two feet.

In the 2d, an ordinary voice could be heard ten feet away, after the opertion, eighteen feet.

In the 3d case, the whispered voice could be heard eighteen inches away; after the operation, eight feet away. The ordinary voice in this case, singularly enough, could be heard twenty feet away before the operation, and twenty feet away afterward.

In the 4th case, the loud voice could be heard fifteen feet away before the operation, and after it an ordinary voice could be heard twenty feet away. The whispered voice could be heard eight feet away.

In the 5th case, the whispered voice could not be heard at all; after the removal of the stapes the whispered voice could be heard at the distance of two feet. The ordinary voice could be heard at the distance of one foot, and after at nine feet.

In the 6th case, the whispered voice could not be heard at all; after the operation, at a distance of two feet; the ordinary voice, not at all before, but after the operation, fifteen feet.

In the 7th case, the ordinary voice could be heard at nine feet away; after the operation, thirty feet and more.

In the 8th case, the whispered voice could be heard four feet away before the operation, and fifteen feet away after it.

In the 9th case, the whispered voice could not be heard at all before the operation, but it could be heard one foot away after. The ordinary voice could be heard two feet before, and twenty-five feet away afterwards.

In the 10th case, the whispered voice could be heard at the distance of two feet before; and three feet, after. The ordinary voice could be heard six feet before the operation, and nine feet, afterwards.

In the 11th case, the hearing was absolutely gone for all sounds except through a conversation tube; after the operation a whisper could be heard at a distance of seven feet, an ordinary voice ten feet, and a loud voice, twenty feet away.

In the 12th case, the ordinary voice could be heard one foot away before the operation, and a loud voice at ten feet; after the operation a loud whisper could be heard ten feet away, and the ordinary voice, thirty feet.

In the 13th case, the whispered voice could be heard two feet away before the operation, and the ordinary voice four feet.

After the operation the whisper could be heard five feet; while the ordinary voice could be heard at a distance of fifteen feet.

In the 14th case, the whispered voice could not be heard; after the operation, it could be heard at a distance of one foot; the ordinary voice was heard at six inches before, and at a distance of seven feet, after. The loud voice five feet away before, and twenty feet, after.

In the 15th case, there was a remarkable condition of the ear; the stapes and incus could not be found. The malleus was removed, and after the operation there was a slight improvement in the hearing.

In the 16th case, a loud voice could be heard at three feet, and a whispered voice at six inches. After removal of both stapes and incus, the loud voice could be heard at thirty feet and whispered voice at six feet.

These are the first sixteen cases reported by Dr. Jack. Since that, the operation has been performed, in all, by Dr. Jack, in 60 cases; Dr. Blake in 21 cases; Dr. Schwartze in 6 cases; Dr. Ludewig in 2 cases, and Dr. Grunnest in 1 case. About 100 cases in all have been reported, so far, of the removal of the stapes. I am very sorry to say that the later cases have not been nearly so favorable in their results as the earlier ones. The reason of this is unknown to me, but that is the fact. At least in two cases, and perhaps in three, the patients, after undergoing the operation have suffered a great deal from long-continued vertigo. Whether the conditions of the patients were very different from those of the earlier patients, I do not know; but you can see that stapedectomy should not be performed except upon the advice of the foremost aurists; and I am sure that when such authorities as Dr. Blake, or Dr. Jack advise that operation, the sooner you have it done the better.

I am sorry that I have no summary of middle-ear operations by Dr. Roosa of New York, one of the most successful aural surgeons in the world and well-known to you on account of his interest in the deaf and dumb. Dr. C. H. Burnett of Philadelphia, has operated upon the bones of the ear, (the incus alone, or incus and head and crura of the stapes), in a number of cases. I am sorry that I have not the statistics of his operations, for they are very interesting. He confines his operations ordinarily to the removal of the incus, and the head of the stapes, and he says that

he is confident that in a great majority of cases as much improvement will result as from removal of the entire stapes, and the operation is a simple one.

[A Voice: I should like to ask Dr. Gordon;—In the successful cases, did the tympanum heal again, or remain open?]

[Dr. Gordon: In many cases the tympanum healed; while in others it has been left entirely open, which is a very desirable condition. It remained open in 21 of Lucae's cases and closed in 6, and the hearing was improved in all.]

I have records of persons on whom this operation has been performed, in which there is not a trace of this membrane left. The middle ear opens up completely, and it is simply a clean and dry passage. The physical condition is much preferable to that of those whose ears are affected by disease, because they are perfectly clean, and give no trouble whatever. An exposure to the air, under different atmospheric conditions, seems to occasion no inconvenience And I may say that in conversations I had with a number of members of the American Society of Otologists which met in June, I was told that in many cases even if this operation did not result in the improvement of the hearing of deaf children it would be highly conducive to the general health and comfort of the deaf. All discharges are easily controlled, and usually stopped completely. In a great many cases there is the disappearance of headaches, and other unpleasant symptoms with which some children are affected. The operation is advised by some of these otologists even when there is no prospect of hearing, on account of the improvement of the general conditions.

[A Voice: Is there any form of disorder likely to result from leaving an opening in the tympanum?]

[Dr. Gordon: There is not. It is considered preferable to keep this open by some physicians; I cannot say that it is by all.]

[A Voice: Is it possible that the removal of the eardrum may occasion inconvenience in swallowing, by leaving an open passage from the throat to the external air through the eustachian tube?]

[Dr. Gordon: In a great many cases the eustachian tube has long ceased to perform its functions. By the way, the eustachian tube is situated so high that I imagine that ordinarily the opening could not interfere with swallowing It is placed

much higher than we commonly imagine. Take this pencil here. If I push the nares up as far as possible, and push directly back, I strike the end of the eustachian tube.]

The object of this discussion of middle ear surgery is to impress upon the minds of all that the "let alone" policy, wisely advised by judicious physicians in the past is not the highest wisdom for the present. The advances made in aural surgery render it imperative to submit every case of deafness to examination from time to time by aural surgeons with reference to the advisability of operative interference either for the improvement of the hearing or the health and comfort of the patient.

Both auto-massage and massage by mechanical devices for the purpose of improving the hearing, through improved condition of the conducting mechanism, due to enforced exercise, have received a great impetus within a few years.

Hommell's method

Hommell's method is a very interesting one, and it has been practiced with very favorable results in certain cases. Dr. Hommell, of Zurich, is a distinguished aurist, who began to lose his hearing a few years ago. He finally hit upon the device named after him, Hommell's method for auto-massage of the conducting mechanism. The operation is a very simple one, and yet it is not advisable to perform it in all cases. He took a finger and pressed upon the tragus, slowly at first, increasing these motions to an operation of one per second for a minute. In some cases the patients will find a peculiar feeling at the end of a minute, and become dizzy. It increases the circulation of the blood in those parts, to say nothing of the mechanical movement of the ankylosed bones. And where the adhesion is not very firm, it has a tendency to mobilize the transmitting mechanism. Hommell recommended that his method of finger-action upon the tragus, be kept up, taking sixty movements per minute for, say a week, when the aurist endeavors to increase the speed to 120 movements per minute. To trace the effect of this, Dr. Hommell tested the hearing from day to day using the ordinary tests employed by physicians and made a chart of the hearing. If the hearing, for two or three days, is diminishing, instead of increasing or holding its own, it is time to stop. But if there is an improvement, this treatment is to be continued. In Dr. Hommell's own case the results were very happy indeed. His hearing increased considerably, and in the case of a number of patients, especially young persons of the ages of eight to fifteen

years, the hearing improved, so that the "Hommell-method" has been introduced as a regular practice of successful physicians and aurists both in Europe and America. I presume that it is safer to have Dr. Hommell's method practiced under the direction of a physician than to undertake it yourself, however simple it may seem to be. For in some cases it is barely possible that you might set up an inflammation in this portion of the ear, which might prove somewhat troublesome.

The question of using the phonograph, or vibrometer, or any other instrument for the purpose of improving the transmitting mechanism was considered by the American Association of Otologists in Washington last month, and the experience of a number of physicians and surgeons was given on that occasion. They were, in general, disposed to resort to other methods of treatment, evidently having little or no confidence in the mechanical massage of the ear for the improvement of the hearing.

But there are reputable physicians who claim to have effected very good results in a number of cases by the use of massage.

Dr. Houghton, of New York City, claims good results, especially in catarrhal cases. There is, first, an increase of circulation in all these parts. You can feel that these parts are stimulated. The sense of smell in many cases is intensified and its power temporarily increased; and in some cases there is an increase in the flow of saliva, proving that there is a stimulating process going on, and the result of the exercise is a better nourishment of the diseased parts due to the nerve-stimulation and better circulation of the blood. The theory is that the vibrations tend to promote the normal condition, and to draw off the effete deposits that exist in many cases; there is, not infrequently, a removal of such deposits, and an increase of the mobility of the parts. But when the adhesion of the plate of the stapes, or of the chain of bones, is as firm as it is in a great many cases we have to deal with, no mobilizing of these parts is possible.

Dr. Bissell, of Rochester, attaches a great deal of importance to sound as a therapeutic agent. He uses vibrating strings for this purpose, and has devised an instrument which he uses in his practice. The strings are connected with a sounding board, and the vibrations are transmitted to the ear by tubes from the board. He claims to have achieved good results in a large percentage of cases, but I am not able to give the figures.

You know that Charcot, the great specialist in Paris, made use of vibratory massage from a stringed instrument in the treatment of nervous disorders. He attached great importance indeed to the vibratory treatment of certain diseased conditions of the brain, and of the nerves.

The instrument with which I have experimented a little myself is one that is manufactured in Baltimore,—the vibrometer. It is essentially a banjo. It has the form of the banjo, the banjo-heads are made of wood and of metal, and there is an air-chamber between these two heads. The heads are set in motion mechanically by devices impelled by an electric motor; and these devices are so adjusted that you can give graduated vibrations, in great variety. These vibrations are transmitted through rubber tubes to the ear. I have not been able to use the vibrometer in many cases, but I have diagrams interesting as far as they go. I have not only used the vibrometer to mobilize the conducting mechanism, but from time to time I measured the degree of hearing for a certain kind of sound, as measured by the audiometer made by Professor Bell and Mr. Clarke. And the results of these measurements I have charted.

I will take the case of a gentleman 84 years old, though I did not advise him to use the vibrometer nor did I discourage his trying it. He used it a short time beginning January 15th. At that time the audiometer reading was one centimeter; the 20th of January the audiometer reading was 2 centimeters; the 23d it was still 2. About that time he took a severe cold, and his hearing dropped. The 25th of January the record was above 1 centimeter. He could barely hear. He resumed the practice, and a day or so later it ran up to 2½ centimeters. And then he took another cold, and down dropped his hearing again. Then we had long spell of delightful weather; he took his "medicine" every day, and worked right along, and his hearing improved until the experiment terminated on the 15th of February. He could then hear at the distance of 3½ centimeters.

Another case was still more defined. This was a young man who had been in Mr. Gillespie's aural class, but after he came to College his hearing deteriorated. He took the exercise on the vibrometer; and I took the audiometer measurements. First it went up, then he took a cold and it went down; then it went up, then was stationary, and then up, and down again. This was at a time when he was working very hard. Then we

had fine weather, and he kept up the exercise, and his hearing improved. Then it dropped a little; and then improved again, the final record indicating considerable improvement in one ear and very slight gain in the other.

[A Voice: Hearing by the audiometer; how about the hearing as tested by the voice?]

[Dr. Gordon: The hearing for the voice became better from time to time; but we cannot always tell from the audiometer. I may say that when this young man began he was not able to hear the ticking of the clock in his room. Afterward he heard his clock constantly. In another case, a young man came to me one day in a state of excitement, and said that at four o'clock he was out on the common, and felt a shock in his ears. This came four times. He happened to look at the tower-clock and it was four o'clock! At five o'clock he felt or heard it strike five times, and ever since that he has been getting a little enjoyment from noticing the strokes of the tower-clock.]

Auditory "Gymnastics"

I should like very much to have spoken of improvement in hearing in cases originally, apparently, beyond hope, through patient and persistent drill with the human voice as practiced by Mr. Gillespie, of Nebraska, for the last ten years or more. The following statement shows what has been accomplished in one school in Germany within the last year under Dr. Urbantschitsch. There were sixty cases in all. When he began there were six of them who could hear words; 22, vowels only, and 33, were totally deaf. This was last October. In April, 12 could hear sentences; 16, words; 21, vowels, and 11, were not improved. The method of treatment is precisely that originated and practiced by Mr. Gillespie, and still followed by his assistants, Mr. and Mrs. Taylor.

Important action

Before I leave the floor, I will take this opportunity to communicate to the profession, through this Association, the action of the American Otological Association at its recent meeting held in Washington, a resolution presented by Dr. Blake of Boston, and discussed by Dr. Blake, Dr. Knapp of New York, Dr. Randall of Philadelphia, and by a number of other prominent otologists:

"Resolved, That it is the sense of this Association that at each institution for the deaf, there should be an experienced aurist to make careful examinations of the condition of the ears of the pupils."

Dr. Blake's motion was seconded and unanimously adopted.

The discussion was brought on by the presentation of copies of very interesting examinations made by Dr. Bliss in the Philadelphia Institution. The report is a wonderfully complete one.

And when the Association of Aurists recommended that every school or institution for the deaf and dumb should have on its staff a competent specialist to examine the organs of hearing and speech, they really meant that they should have on their staff such a man as Dr. Bliss with full power to act. (Applause.)

LECTURE II.

Let me call your attention, in the first place, and briefly, to a lesson from one of the most fruitful branches of science, that of psychophysics, which is based upon the study of the anatomy and physiology of the human organs, connected with the development of mind. If there is anything that should be interesting to us, it is the question of mind-building, for mind-building is very closely related to brain-building which in turn is dependent upon the right exercise of brain functions. It is the habit now-a-days in speaking of articulation teaching, to base its importance, chiefly on the utility of speech and lip-reading,—a very important use,—as a means of communication. But I think that there is a greater utility underlying it. I do not wish to be understood for a moment as undervaluing speech and lip-reading as a means of communication; but if lip-reading were much worse than it is; even if the speech were a great deal worse than it is, I hold it is so important to the cultivation of the structure of the brain itself, and the development of the mind itself, that for these ends alone it would be worth while to spend all the time and effort spent upon articulation teaching. (Applause.)

Professor ~~Merrill~~ Gates has been engaged for the last fifteen years in original researches in psychophysics. His experiments have not been confined to the human brain, but he has experimented upon the brains of animals, and his experiments have been very instructive. For instance, as related by him in a recent lecture, he has experimented upon young puppies. He took three puppies of the same litter. Number One was permitted to lead the normal life of a young dog; Number Two had his eyes

completely bandaged and lived in absolute darkness. Number Three was allowed all the privileges good for puppies, and in addition much time was given to the training of its sense of sight. The animal thus trained could distinguish many different shades of color, not recognized by dogs usually. After some months the three dogs were killed and examined. The parts of the brain which had to do with the function of sight were wholly undeveloped in the puppy that had been blinded. In the educated puppy they were twenty-five times better developed than in the ordinary dog, being almost equal to the same portions of the human brain. The developed portions of the brain-substance were more dense, supplied by more blood-vessels, had more cells, and more highly developed cells, than the corresponding structure of the normal dog. Like results were obtained with other animals. Similar experiments upon the ears led to similar results upon the hearing-centers in the brain. In the course of these experiments, he found that wherever any physical link for transmitting impressions was restrained or disused, be it what it might, there was a corresponding lack of development in the brain. Now therein lies an important lesson for us. If our deaf children are not taught to speak, and to use all the organs of speech as normal children do, there are many cells and nerves not properly used. And if we had the scientific eye, we could see in the atrophied brain of such children the effect of the lack of symmetrical or normal development.

To return to my subject.

I wish to make a few observations upon articulation teaching in the College. The Congress of the United States, in 1891, by a special appropriation for the purpose of affording instruction to the students of the National College, enabled the authorities of the Institution to take a step long contemplated; and the continued liberality of the Government has made it possible to keep up the Department of Articulation to the present day. Some may think we have been a little slow at Washington, but you must remember that we live quite far South; and though we move slowly, I have no doubt that we move surely, and we hope not to make any serious mistakes. We shall try to keep somewhere in the procession.

In the prosecution of the work of this department, a persistent effort has been made by brief special lessons given daily,

to preserve and improve the speech of all the students in the College who came to us with these powers, and we have also carried to the point of success an experiment of which I shall speak at length later on.

At Chicago, last summer, all persons specially interested in our work had, in lieu of a "living exhibit," an opportunity to examine the records of the ordinary practice in lip-reading from the lips of the teachers by every student in the College for an entire term, as recorded by the lip-readers themselves.

I may say that the first two terms of each year in this Department, are occupied mainly in instruction and drill and practice in articulation, in speech, with incidental lip-reading. The third term the emphasis is thrown upon lip-reading, and for various reasons I find it desirable to insist upon their recording nearly everything that they read during the short time allotted to this exercise. That enables us to have a record of lip-reading actually performed by each student under the instructors of this Department for a single term in the year.

I have spoken of "lip-reading." And I may say that I used to be something of a reformer; and held very strongly to "speech-reading" as the proper and most expressive term, coming nearest to the idea we wish to convey. But I am inclined to abandon that term, for the newspapers gave accounts of how we were teaching deaf-mutes to speak, and said we made orators of them; that they became great "speech-readers." And in general I think it is a hazardous experiment to undertake to force new meanings into old words; and as lip-reading has the authority of the dictionaries, I think we are safe in using "lip-reading" as more likely to be generally understood.

To give some idea of the lip-reading by different students, I take great pleasure in submitting these "echoes" from the classrooms in the form of books, containing the entire record of lip-reading in the College for the term just closed. I may say that each "book" contains the record of lip-reading of various persons with the personal history of each case.

Perhaps this would be a good time to introduce another matter. I may say that among semi-mutes, the greatest difficulty that I have found in the lip-reading and speech, arises largely from their imperfect knowledge of phonetics, of the mechanism of speech. I agree thoroughly with everything said in Mrs. Bell's paper; but at the same time I think that if one is

to become a fair musician, and he has not a great genius for music, the more scale-practice you give him the better, in the end. And I have not been able to find any better method of drill than the method based upon that admirable analysis of speech given in "Visible Speech."

I have made a study of as many cases of proficiency in lip-reading by semi-mutes, as possible; I know many of them personally; I have corresponded with many, and I find in general that semi-mutes, no matter how well they speak, are not very familiar with any form of phonetic analysis. Systematic drill in phonetic analysis tends to help the eye, to fix the skeleton forms of words, and to fix forever their pronunciation as well as appearance. My own best results have been obtained (and I refer to work done years ago, for I am not engaged in the practice of this art now), by drill, first, on a limited number of elements, reading them from the lips, speaking them as uttered, and also writing them in definite and plain symbols. I have here with me a simple outline of the drill which I used in 1870, I think, and in 1871 and 1872, with excellent results.

I will not stop to give you that now. In the first series it was confined to exercises upon lip-reading,—all the permutations of "p," "t," "q" or "b," "t," "v." After they were mastered, I permitted my scholars to advance to the second series. This series gave us the largest rounded mouth-opening vowel in "ah," and the tiny rounded opening in "oo," and the broadening of the lips in the very visible long "e," "ah," "oo." These any one but a blind man can read; the idea was to select those elements most visible and most differentiated, and we practiced the permutations upon this series. Then we combined the first series with the second, and then we passed to the third series,—"th" "l," "aw" (ɟ), and then, after my class had mastered these, I passed backwards again and combined them with the other series, and so on.

Then we had a syllabic drill; I preferred to take a single vowel and begin with a consonant, and then to take another set of exercises beginning with a vowel and ending with a consonant. Then for another exercise, the same syllables were to be repeated, as mamma, lala, duhduh, buhbuh. Then we advanced to one consonant between two like vowels. Then one consonant between two different vowels. And then we advanced to two syllables. Here we took different consonants

with the same vowels, and *vice-versa*, and then advanced to two syllables in which all the elements were different.

And about this time I introduced some simple, easily visible words used by many teachers successfully.

[Here the speaker gave quite an extensive list.]

Then I felt I was ready to begin simple narrative, and I was always anxious to find whether the pupil had committed anything to memory, rhymes or jingles, names of the States, — no matter what, and I would try to get them to repeat them from my lips. If they had forgotten half, so much the better for the lip-reading, — knowing the general run of the thing, and not the precise words. They would seemingly make considerable progress, with such verbal exercises; in reality, the progress was not great, but it encouraged them very much. Thus we proceeded from the known to the unknown, every once in a while working in these phonetic drills or rather lip-reading drills in review.

I will digress once more to say that there is a lady present, from New York City, Miss Keeler, who has had a number of adult pupils sent to her who had speech, but not lip-reading. Rev. Dr. Gallaudet, knowing her work, has recommended her in a number of cases, and many adults have taken lessons of her. She has a system which is probably a great deal better than mine, — though any method is better than none, and therefore I praise my own. But hers is the result of a great deal of study. She has not only worked out a general scheme, but the exact exercises which she will use from lesson to lesson, from day to day, so that not a moment is lost in thinking of what she shall say to her pupils. She can go through with such exercises with great ease and rapidity, and I hope the opportunity may be afforded her to give us a precise account of her method. It may eventually be published, so that all may have the benefit of the exercises.

I may say that I used my series of exercises with one of my normal classes, and endeavored to have it used with some classes in the college; but there was considerable friction. A great many students did not exactly see the necessity of anything so dry, and promising so little immediate result; they could talk very well without that. And it did not seem advisable to insist upon their following a dry routine where they did not fully comprehend what the outcome might be, and where it might not meet my own expectations. But in the case of my own pupils

in years gone by the results were very happy indeed. It was designed to meet the needs of intelligent students, who would persevere in practice. Secondarily the exercises cultivated the voice, and improved the distinctness of speech.

Among these exercises, I have two volumes made up of the lip-reading for the term which just closed, by grown-up pupils, beginners who came to us unable to utter the simplest sentence. That is, the adult-beginners in speech,—41 in all,—of whom 14 were between 18 and 21 years of age; and 27 were between 21 and 28 years of age; 33 were men, and 8 were women. Of these, 15 were born deaf, or became deaf in early childhood; 7, at one year; 8, at 2 years; 5, at 3 years; and 6, at 5 years; making 41 in all. One of these adults came from New England; 13 from the Middle States; 8 from the Southern States; 18 from the Western States, and 1 from Canada. The first year there were 28 beginners, the second year 8, and the third year 5.

I meant to say somewhere that this experiment was an unique one. This experiment of teaching these grown-up deaf-mutes to speak and read the lips is without recorded parallel in the history of deaf-mute instruction. I have not been able to find a record of anything like it in the whole history of our work. So it possesses that one interest, if no other.

Now of these 41, 8 left college, 6 dropped articulation at their own earnest request, and 18 are still under instruction. And the records I have with me are the records of these 18.

I may say that a peculiarity which was noticed in regard to these 41 adult beginners in speech is that their lung capacity is "short." And it is an interesting fact, for though it may not have a direct bearing upon their speech, it may have an important bearing upon methods, means and appliances in education. The average lung capacity of the males is 243 cubic inches. That compares favorably with the average of the public at large where a large number of persons is taken into account. But it is ten cubic inches less than that of a university class, and 88 cubic inches less than that of the same number of university men of the same height, presumably devoting the same attention to athletic exercises. A remarkable difference. Eighty-eight cubic inches in young men devoted to athletic pursuits. The breathing habits are defective. They should have been carefully trained in their childhood.

The laryngeal development in a number of cases was incomplete. I regret that the notes of the laryngoscope examinations have been mislaid, so that I cannot use them. The speech acquired is generally slow and labored; the voices are usually weak, but with few exceptions not at all unpleasant. Every hour one spends in a crowded city, you will hear voices that are unpleasant, and many voices as difficult to understand. The intelligibility of the speech varies considerably. In certain cases, on certain occasions, where the speakers were embarrassed or fatigued, the speech was unintelligible, as a whole to me. The teachers did not seem to have difficulty in understanding them, but the speech was not intelligible to me, although I think I have always been able to understand some words in every sentence. I am inclined to think, however, that every case would pass muster according to the sensible dictum laid down by Dr. Williams, of Hartford: "Any pupil who has mastered speech and lip-reading so far as to be able to carry on conversation in regard to the ordinary affairs of life in speech so plain as to be readily understood by persons of his own family, even though others fail to understand him, should be accounted as a successful articulator and lip-reader." (Applause.)

The degree of proficiency attained is such that with a fixed determination to use speech, it would be possible for at least 30 of the whole number to depend upon it. There were 41 cases in all. Eight dropped out after one year. Of the remainder, 30 of them, I think, could make use of speech freely with their immediate friends, and 20 could use speech if they so chose in all the ordinary business of life.

The devotion, skill and enthusiasm in teaching shown by Miss Gordon, our senior teacher, and Miss Fish, who has had charge of nearly all of this section, and to whom the development of speech is due, have been met by unusual difficulties. It should not be forgotten, that the mere age of the student was not the chief barrier in the way of success; in many cases there was so complete a degree of satisfaction with their fixed habits of communication that but a languid, temporary, or perfunctory interest, could be aroused. In a few cases there was a positive prejudice, which it was exceedingly difficult, if not impossible to overcome. There was too little time available for the best results. Our College program is almost as crowded as Chautauqua's.

[A Voice: How much time have the students had in their speech-work?]

[Dr. Gordon: These beginners are arranged as nearly as possible in small classes, not exceeding six in a class, and the time devoted for a single exercise is half an hour, and the individual instruction never exceeds fifteen minutes at the most. The results are remarkable when everything is considered. In all cases there is too little time for the best results. Then, too, if a working system is employed at all, the students in speech need the stimulus of recorded work. In the speaker's opinion the work in articulation should be included hereafter in the regular curriculum of the College. I think perhaps the time has not come yet, but I think it is approaching when so many will come to us with speech and lip-reading already acquired that it will be well just to take it as a matter of course, that they should go right on with their constant usage of speech and lip-reading.]

In conclusion, I may say that it is exceedingly difficult to form the "speech-habit" in adult life; and for this reason it is better for the pupils to begin when they are young. The intelligence, and knowledge of language, which these grown-up beginners brought to bear upon their work enabled them to accomplish as much in speech in one year as might be expected of young children in two or even three years. But this great advantage does not balance the influence of the acquired and inveterate habit of silent methods and the complete degree of satisfaction with these methods of communication, nor is it possible to secure in adult life the full development of the sound-producing organs. It should be borne in mind that every one of these forty-one adults came to the College dumb, from schools in which an effort was made to teach all promising pupils speech and lip-reading. Practically they were all rejected cases without trial or with little trial, with the exception of one young woman who had had five years of instruction in the early part of her course, and was then dropped as an unpromising subject.

I am, from my own observation, convinced that every one of them was a suitable subject for oral instruction.

The final lesson is this:—

Let us not be too easily discouraged with unpromising cases. I cannot do better in closing than to refer to one of

these: Among the beginners in the first year the most discouraging was that of a man born deaf, 21 years of age, without a vestige of hearing. An observer wrote of him as follows: "After three weeks of instruction, Z——— is a problem. He has very little power of imitation, and still less of memory, and, to make matters worse, he is very slow to understand what you mean. His lack of memory of positions, probably, has the most effect, for even when he gets an element right, he cannot remember the position in order to repeat it. His improvement is almost imperceptible." Three weeks later the observer says: "Z——— has made considerable progress. The sentence I gave to him was given back to me, and repeated very well."

A week later: "Z——— has improved considerably, but it is slowly, step by step." At the June examinations at the close of his first year, this unpromising student read from his teacher's lips 695 words with 9 failures, and spoke 688 words with 46 failures.

Now I know as little about what he has read from the lips as you do. I see here he has the names of all the faculty. That was February 1st. These are the daily lessons, you understand.

March 12, he records: "It is a beautiful day. I met a pretty girl. Did you go to the market? Prof. Porter went to see it. Did you see Miss Taylor? She returned to Philadelphia yesterday. She will go to Portland, Maine, next week. Prof. Porter is much better. He will come down."

April 16: "When did you hear from home? What day of the month is this? What month is this?"

May 7: "How did you enjoy the ball? Please tell me about it. I came home at 12 o'clock."

This is lip-reading from this unpromising student; he is not a good lip-reader, and would not be pronounced a promising case, but he has accomplished a good deal under the circumstances.

I will turn to Miss Kershner's case. It is an interesting one. She has a number of deaf-mute relatives, and was born deaf. She entered the Philadelphia school, and attended it nine years. She entered the College in 1892 and began then to learn to speak and to read the lips.

[Reading records from January 19 to May 25.]

[Dr. Bell: How are these records made?]

[Dr. Gordon: The teacher sits before the class, talks to the class, tells stories, and asks questions. They sit with their little books open and write, and are expected to speak all that the teacher says. I prefer that they should both speak and write what they see upon the lips. It is a record of their lip-reading. In some cases they have not given every word, or have made mistakes which have been underscored. They are not always required to get the word the first time, but their time is limited. Some words might have been repeated two or three times. It is taken from the lips. "Do you think it is very cold for the first day of summer?" (Reading June First.) That was read in one exercise from the teacher's lips in Miss Kershner's second year.]

[A voice: Sentence by sentence?]

[Dr. Gordon: Generally sentence by sentence, sometimes word by word, and sometimes right ahead. Of course this could not have been given right off.]

[June 8. Reading from the MSS.]

This is from Emma Kershner's exercises. If time permitted I should like to run over some other lip-reading by some who have had more practice and knowledge of speech than she.

[Dr. Bell: I understand that these you have read are——?]

[Dr. Gordon: Grown-up deaf-mutes without previous instruction in speech and lip-reading.]

Let me call your attention to something I failed to present yesterday. I had the promise from Dr. Lucien Howe of Buffalo of a collection of ear-bones. But he disappointed me, and sent me photographs instead. I suppose he knew the reputation of Chautauqua, and was afraid to trust those valuables on these grounds. Here are photographs of the ear-bones of man, the whale, the elephant, etc., which you can examine at your leisure, and return to me if you please. I am obliged to you. (Applause).